4.6 Challenges and Data Gaps

This chapter described key indicators for health and exposure. Many exposure indicators presented were measured by biomonitoring. Where biomonitoring data are not available, ambient exposure measures serve to describe human exposure to key environmental pollutants. Areas where strong associations have been demonstrated between environmental exposures and health outcomes were highlighted. However, in many areas those associations have not yet been demonstrated.

The success of environmental decisions in improving public health can be measured on a variety of levels:

■ **National level** (e.g., U.S. Department of Health and Human Services' Healthy People 2010 initiative).

■ **Geographic/regional level** (e.g., East Coast versus West Coast, CDC's state health reports).

■ **Community level** (e.g., air and water quality monitoring).

■ **Individual level** (e.g., screening programs for blood lead in children).

Many indicators may be used at a number or all of these levels. This report has focused on describing indicators and impacts at a national level. Future versions of this report may utilize indicators to evaluate success in reducing environmental health exposure and outcomes at some of the other levels as well.

Use of Health Outcome Measures to Evaluate Environmental Policy Decisions or Interventions

Mortality data were chosen as one of the major disease indicators because these are collected nationwide in every state, county, and community. These mortality data constitute a comprehensive database, since every death is presumed to be reported. This information has been collected for more than the past 50 years and has been used to document the success of major public health programs. For example, treatment of drinking water through filtration or chlorination eliminated diarrhea diseases as a major cause of death in the 20th century. More recently, anti-smoking campaigns aimed at men are believed to be responsible for the sudden downward trend in deaths due to lung cancer. In fact, an analysis of the key indicators of health for the country confirm that the health of the U.S. population is improving. The U.S. population is living longer (life expectancy) and death rates for major causes of death (cancer, cardiovascular disease) are declining. Except for those rare diseases that have a short survival period and 100 percent death rate, death represents

only a small fraction of the true number of cases for a disease in the population (see Section 4.2).

Better information and insight into the health of the U.S. population can be obtained from evaluating incidence data (new cases of illness) or prevalence data (all existing cases of illness). At this time, no comprehensive nationwide systems for collecting incidence or prevalence data on disease are in place. The majority of morbidity data reported in this chapter are available either from national surveys that sample the U.S. and are assumed to be representative of the nation, or from data (e.g., birth defects and cancer registries) collected by the state-based centers around the country. The actual picture of health may differ from that suggested by the data, as in the case of childhood asthma prevalence that has been rising (as described in Section 4.3.4). CDC has launched an initiative to improve the nation's health tracking system. CDC recently awarded grants to state and local health departments to begin developing a national environmental health tracking network and to develop capacity in monitoring environmental health at the state and local levels (<http://www.cdc.gov/nceh/tracking/EPHTracking/EPHTracking.htm>).

Several emerging areas of health concern (e.g., Parkinson's disease, diabetes) and emerging areas of environmental exposure (e.g., endocrine disrupters) were recognized in this chapter. In many of these areas, either the link between environmental exposures and the disease has not been established or no systematic surveillance or established indicators currently exist. Future reports may well include many of the diseases and exposures identified as emerging issues and may establish associated indicators. Major efforts to address diabetes, asthma, and obesity also present a very promising opportunity to incorporate research on the role of environmental exposures into such plans.

Use of Exposure Measures to Evaluate Environmental Policy Decisions or Interventions

Most exposure indicators described in this chapter were biomonitoring indicators. Ambient exposure measures were described for a number of areas where, at present, biomonitoring data are not available (e.g., for certain air pollutants where there are no markers in blood or urine).

The NHANES data provide examples where biomonitoring data have reflected a public health benefit from EPA actions. For example, the decline in blood lead levels confirms that the removal of lead from gasoline, water, and paint has successfully reduced exposures. Similarly, the decline in urinary cotinine levels demonstrates that efforts to reduce smoking have led to public health improvements. However, interpretation of many of the other exposure indicators is difficult at this time. Either not enough is known about the exposure levels in the population, or data gathering at a national level has just begun. It will take time for a stable reference base to emerge.

Efforts to establish a national reference base are under way through the work of CDC's National Center for Environmental Health, which is developing the National Human Exposure to Environmental Chemicals Report. The first report was released in 2001 (<http://www.cdc.gov/nceh/dls/report/PDF/CompleteReport.pdf>) and a second one was released in January 2003 with data on 116 chemicals (<http://www.cdc.gov/humanexposure>). CDC is committed to expanding this database, and its recent *Federal Register* notice called for nominations of chemicals to consider for inclusion in the third report, to be published in 2005. The report will fill a critical need to describe exposure. Use of the report indicators for explanatory or predictive functions will require an understanding of pathways and sources that may have contributed to the exposure and the exposure's relationships to health effects. With this additional understanding the report ultimately could be used to guide exposure reduction programs.

Monitoring Environmental Health Status at the Community Level

Except for mortality data, many communities must look to their own local public health officials to monitor the health status of their community. This is true for a number of reasons, including:

■ Current health surveys have limited application at the community level and often require extrapolation from a larger population (state or national).

■ Current disease reporting systems, whether national sample or reporting systems (e.g., National Notifiable Diseases Reporting System), can rarely provide an answer for a specific community.

■ Biomonitoring surveys that apply to specific communities are extremely rare. For example, blood lead screening programs, while common across the country, do not report in a systematic fashion to a centralized location for compilation and analysis of the data.

Until such systems are developed, communities will continue to rely on environmental monitoring programs to tell them about their exposure to air or water pollution. EPA is pursuing a number of activities to increase the capacity of information providers (e.g., states) and users (e.g., communities) to share information. This effort includes working closely with other federal agencies, such as CDC, to build compatible systems for linking health and environmental data bases. One potential outcome of such partnerships is an opportunity to revisit and refine current sampling designs such that future data collection efforts would provide better information for smaller units (community level) and would ensure better temporal and spatial congruence between environmental, biomonitoring, and surveillance programs.

Future Challenges

For EPA to make better use of more direct indicators of public health outcomes, the science underlying the Agency's key public health functions (describe, explain, predict, evaluate) will need to be strengthened. EPA will continue to work on providing a better understanding of the components of the source-dose-health continuum (Exhibit 4-1). Key among them will be establishing the necessary degree of predictive validity between indicators of each component (e.g., exposure versus dose). Such an understanding is critical to defining the degree to which one indicator can be successfully used as a surrogate for another. However, this may not be conducive to widespread use in surveys or may be difficult to ascertain in smaller populations (e.g., at a community level).

EPA also will continue to build collaborations with CDC and other federal agencies responsible for collecting health surveillance and human exposure data. Such partnerships are essential to any effort to describe the status and trends of exposure and disease in the U.S. with the eventual goal of every U.S. citizen understanding what the status is for his or her family and community. An important initiative along these lines is the interagency effort to develop the National Children's Study, in which EPA is a collaborator. The Children's Health Act of 2000 authorized the National Institutes of Child Health and Disease and a consortium of federal agencies "to conduct a national longitudinal study of environmental influences on children's health and development." The study will investigate the interaction of biologic, genetic, social, and environmental factors to better understand their role(s) in children's health.

EPA will also seek to develop and evaluate methodologies for understanding the contribution of other risk factors to a given health condition in comparison to the environmental exposure (i.e., partitioning out the risk attributable to the environmental exposure[s] of concern). Such measures will assist in prioritizing intervention/prevention programs and will allow the benefits and cost of environmental management to be placed in the context of the larger public health picture.

Other issues of emerging, or emerged, concern include:

■ **Susceptible populations.** This chapter identified children as a susceptible population and described indicators relating specifically to them. EPA also recently announced an initiative to define the environmental risks associated with the ever-increasing aging population (<http://www.epa.gov/epahome/headline_103002.htm>) to be undertaken in partnership with other federal agencies and the many alliances for the aging. Many of the indicators in this report are particularly relevant to the elderly (e.g., cardiovascular disease, chronic obstructive pulmonary disease), and they are, or can be, reported by age group. As other susceptible populations are identified, EPA will need to continue working with its federal partners to see that the data are collected and analyzed to track those populations.

■ **Aggregate and cumulative risks.** Individuals are not exposed to single chemicals, but rather to multiple pollutants and other stressors through multiple pathways and routes over the course of a day. The reality of aggregate and cumulative exposures further complicates attempts to attribute risk to a single environmental agent. EPA has begun to look at this issue, stimulated in part by mandates under the Food Quality Protection Act. The recently released Cumulative Risk Guidance report (EPA, 2003e) lays the groundwork for taking on this challenge and will help target the research to better understand the nature and impact of such "composite" exposures, especially as related to targeting regulatory and health prevention strategies.

Finally, the health and exposure indicators described in this chapter are only a portion of the story on the state of the environment. These indicators should be viewed in conjunction with the other indicators identified in the companion chapters on ecological condition, land, air, and water. As presented in Exhibit 4-1, that integration is vital to fully developing the understanding envisioned by the cascade of events from source to effects.